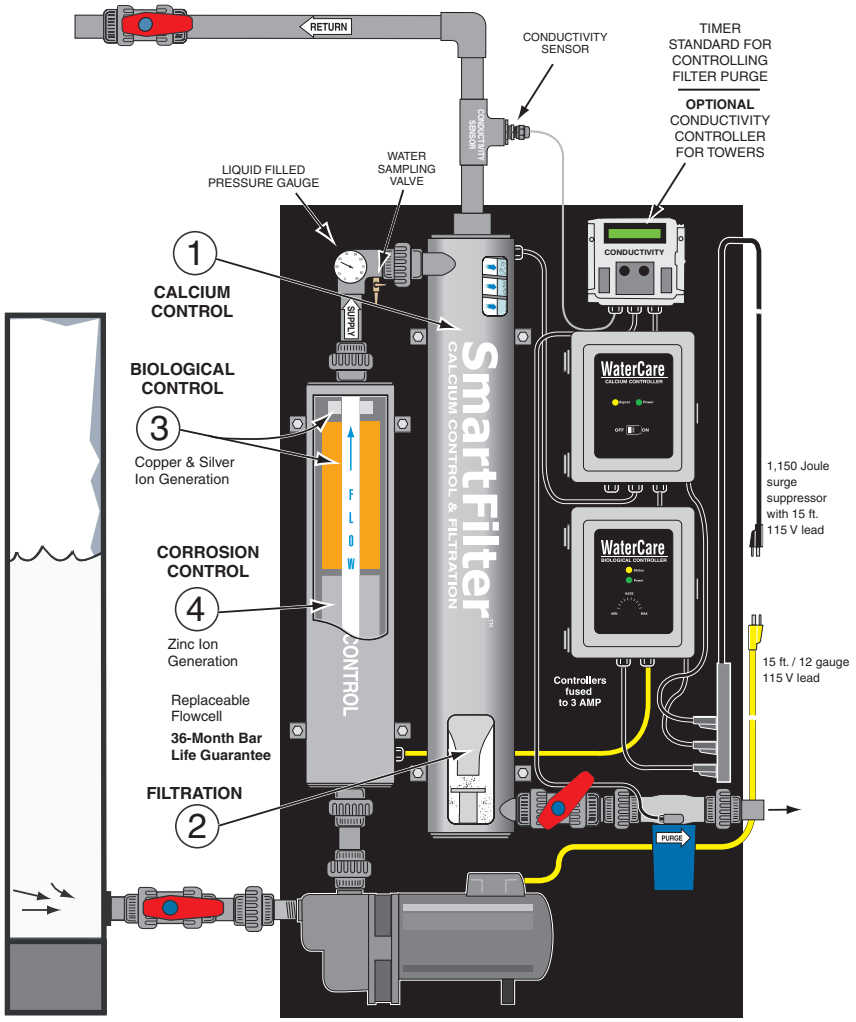
NON-CHEMICAL

NEXTEQ WaterCare™ Systems

INSTALLATION, START-UP AND OPERATION - USER MANUAL



Model Shown: SF-2000-4:1-PCV • 36" x 60" x 10" - Approx. Wt. 300 lbs.

COMPONENT	FUNCTION
Timer or Optional Conductivity Controller	Regulates filter purge
Calcium Controller	Supplies the current that generates electromagnetic fields within the 2-in-1 SmartFilter
Biological & Corrosion Controller	Regulates the DC voltage used to generate the copper, silver & zinc ions
Replaceable Metals Flowcell	36 Month Bar Life Guarantee
1,150 Joule UL Listed Surge Suppressor	Distributes 115 VAC power to the 3 controllers
Purge to Sanitary Drain	Manual ball valve is used to reduce flow to drain when actuated ball valve is open. This ensures the bleed rate does not exceed the make-up supply rate.
Self-Priming Pump (See below)	Pre-wired for 115 VAC. Use GFCI protected circuit. OPD-Standard/TEFC optional

PUMP INFO

SYSTEM	PUMP	SUC.	115/230V/1P	GPM
SF-500-4:1	1/3 HP	1"	8 / 4 AMP	25 GPM
SF-1000-4:1	1/2 HP	1.25"	10 / 5 AMP	40 GPM
SF-2000-4:1	3/4 HP	1.25"	13 / 7 AMP	50 GPM
SF-3000-4:1	1.0 HP	1.25"	17 / 9 AMP	60 GPM
SF-4000-4:1	1.5 HP	1.5"	18 / 9 AMP	75 GPM
SF-5000-4:1	2.0 HP	2.0"	USE 230/460	100 GPM

System supplied with:

- Copper test kit
- Handheld conductivity meter (towers)
- Biological test kit
- Alkalinity test kit (chillers)
- User manuals

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Installation, Start-up And Operation - User Manual

BACKGROUND - WaterCare System with Integral Recirculation Pump

1. **WaterCare Systems** are heavy. Please handle system with care. DO NOT DROP SYSTEM.

The pump, metals flowcell and other components make the HDPE enclosure the system is built into very heavy. Please use all care and the appropriate number of people and equipment when handling and installing. The enclosure should be securely anchored to the floor or a wall. Also review the information provided in the **Background, Operation & Use** presentation.

2. **Plumbing Considerations** - Pipe Work: Consult the chart below for the appropriate pipe diameters for the supply, the return and filter purge pipe work. The supply pipe work should always be the next size larger pipe than connection to the pump. This minimizes reduced flow to the pump caused by the friction along the pipe wall and any elbows. A 90-degree elbow can reduce flow by 5% and induce turbulence that could cause cavitation within the pump. All glued connections must be allowed to cure (per the manufacturer's instructions) before introducing pressurized water into the system.

CONNECTION	SUPPLY PIPE	RETURN
1.00"	use 1.25"	use 1.00"
1.25"	use 1.50"	use 1.25"
1.50"	use 2.0"	use 1.50"
2.00"	use 2.5"	use 2.00"
2.50"	use 3.0"	use 2.50"

SmartFilter purge pipe work is always 1.25"

NOTE: NEVER RUN THE PUMP DRY (WITHOUT WATER) NOT EVEN TO TEST THE PUMP!

Recirculation Loop Supply - Often an existing tower drain nipple or sump tank drain pipe work can be used, depending its location, to create the side-stream loop for the WaterCare System. If this is not available then installing a nipple, or bulkhead fitting on a poly tank, can be used. It is best to install this as low as possible on the tank so more debris can be pulled into the continuous recirculation loop.

Please locate the supply pipe work so that it does not compete with the larger supply to the tower or evaporative condenser pump. Also make sure the air captured in the returning tower water cannot be pulled into the WaterCare System. Air bubbles can cause cavitation and damage a pump.

Isolating the WaterCare System - Manual isolation valves should be installed in both the supply and return pipe work so the WaterCare System can be isolated for service. The manual valve in the return pipe work stops back syphoning if the return is plumbed below the waterline. This valve can also be used to adjust back-pressure to run the pump optimally.

Debris - In some instances, there can be a lot of fine debris that cannot be seen in the moving water that is not removed without filtration. The SmartFilter is a very efficient centrifugal filter that continuously removes dirt and debris from the recirculating water and stores the debris at the base of the SmartFilter (see cover illustration where purge-to-drain ties into the flowcell).

The volume of debris removed by the SmartFilter during initial start-up can be small (less than a quart or a litre) but, if it is heavy, there could be enough of it to fill the purge pipe work and plug it solid. For this reason, whether on an existing or new facility, the purge to drain should be manually purged at least daily for the first two weeks of operation. Push the **TEST** button on either the TIMER or the CONDUCTIVITY CONTROLLER to manually purge the SmartFilter.

Basket strainers - A *Y-strainer* is never recommended as it rarely has enough capacity to handle any significant amount of debris and, for this reason, can require frequent attention. In addition, if it becomes filled with debris it can inhibit flow to the pump and cause premature failure of the pump seal.

A high capacity basket strainer, installed with isolation valves in the supply pipe work ahead of a WaterCare System pump, is recommended. Many basket strainers are available commercially or Nexteq could supply one. Using a basket strainer with a clear lid makes it easier for maintenance people to determine when the basket strainer requires cleaning.

Conductivity Controller Sensor & Fitting - The conductivity controller is comes with a conductivity sensor that has a 1" NPT male thread. The sensor has a figure of 8 shape. Make sure the narrowest end of the sensor is pointed into the oncoming flow to inhibit blunt force fouling. Clean sensor quarterly with CLR.

In some cases the sensor will be pre-installed at the top of the WaterCare System. When not pre-installed within the system, install the sensor in a 1" NPT reducer bushing into a TEE suitable to be plumbed into the size of pipe work used for system. Make sure the TEE & Sensor is installed at least 24" away from any elbows so as to minimize poor readings caused by any turbulence. Install in the vertical position when possible.

If the TEE & sensor is being installed in horizontal flow make sure the TEE is at least 24" away from any elbows and have the TEE point vertically so the sensor is pointing down into the passing flow. This keeps debris from collection on the surface of the sensor.

Plumber's Teflon tape is normally wrapped around the sensor threads to create a watertight seal. Never over-tighten the sensor as this may crack the plumbing fittings.

Clear Pipe for Purge - Using a length of CLEAR 1.25" PVC pipe (Sch. 40 is fine) in the purge pipe work allows operators or maintenance personnel to see the debris in a purge cycle and also fine tune the purge flow rate. Clear flex-hose is a good alternative to PVC pipe, as it will not have the hard 90-degree elbow bends to slow down the flow carrying the debris to the sanitary drain.

Make-Up Water Supply - Never plumb the make-up water supply pipe work for a cooling tower application into the suction side of the WaterCare System's recirculation pump.

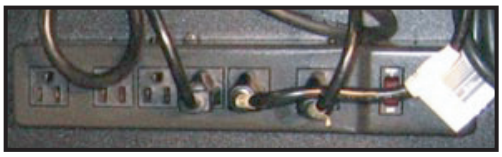
3. Pump Seals: Pump seals are **NOT** covered by the pump manufacture's warranty or Nexteq's warranty. A pump motor can run at 3,500+ RPM so running a pump dry (without water) causes friction and the heat that is generated can destroy a pump seal very quickly.

NOTE: NEVER RUN THE PUMP DRY! (WITHOUT WATER TO COOL THE PUMP SEAL)

4. System Pump - Electrical: Smaller systems (500 to 3,000 gallons) are typically supplied with 115V/1P OPD (open drip proof) pumps. 230/460/3P pumps are optional as are TEFC (totally enclose fan cooled) pumps. Systems with 115V/1P pumps are supplied pre-wired with an 115V 15-foot/12 gauge/3C cable.

Consult the chart on the cover page to determine the amperage draw for 115V/1P pump. 115V/1P pumps should be connected to a GFCI circuit. Normally, most customers find it is more cost effective to run pumps for systems 3,000 gallons or larger with 230/460/3P pumps.

230V/460V/3P pumps are available. 575V/3P pumps are also available. These pumps are not supplied pre-wired or with a starter.



5. System Controllers - Electrical: For user convenience, WaterCare System's 115V controllers are all pre-wired and plugged into a UL Listed 1,150 Joule surge suppression power bar. The surge bar protects against a power surge "spike" but not a sustained surge. In addition, the WaterCare System controllers have varistors on the transformers as a second layer of protection to reduce the risk of damage from power surges.

A sustained surge can destroy the bridge rectifier in each controller. This part is not covered under warranty. Any service, repair and transportation costs related to this repair are not covered under the **36-Month Parts & Labor Warranty.** If your site gets frequent sustained power surges the 115V/1P power supply to the WaterCare System should be protected further against these sustained surges.

The surge bar also provides one-button shut off for the WaterCare System controllers, timer or conductivity controller. WaterCare System controllers are also individually fused with either 3 amp or 5 amp fuses in surface mounted fuse holders located on the inside **ON/OFF** controller panel.

Always turn **OFF** controllers using the surge bar and disconnect (or lock-off) the power supply for any service.

6. WaterCare System Controllers - **Protection Against Overheating**: The WaterCare System controllers have internal fans for continuous cooling. In addition, the WaterCare System controllers have thermistors built into the potted controller boards that will throttle the controllers back during periods of very high temperatures. This keeps them from the overheating that could potentially destroy the board or some of its components.

7. WaterCare System Controllers - Wiring Diagram: See wiring diagrams on the last page for details on the Power Supply and OUTPUT for the controllers' internal connections.

8. Test Kits - Systems are supplied with the following water test kits & supplies:

Cooling Towers:

i Biological test kit - determines number of bacteria in the bulk water.
ii. Copper test kit - drop test determines the amount of copper in the bulk water
iii. Handheld conductivity meter - used to calibrate the conductivity controller and its sensor

Chilled Water Loops or Closed Cooling Loops

iv. Alkalinity test kit - alkalinity is the key to minimizing corrosion in a closed loop.

Always follow proper sampling method (purge old water from sample valve).

9. WATER TEST KITS & SUPPLIERS:

Biosan Laboratory - www.biosan.com 586-775-8970 or 800-253-6800

i. Bacteria test kit is call the SaniCheck - B Part #210 - $48.50 for box of ten tests

LaMotte Company - www.lamotte.com 410-778-3100

ii. Copper test kit - Part # 3617 - $14.95 each
iii. Handheld conductivity meter (EC/TDS/Temp) - Part # 1749 $83.95 each

Alternative - handheld meter (EC/pH/TDS/Temp) - Part # 184241 $135.00 each

iv. Alkalinity test kit Part # 7240-01 $37.95 each (chillers only)

COOLING TOWER APPLICATIONS - 500 to 7,500 Gallon Systems

START-UP & OPERATION - WaterCare Systems with Integral Recirculation Pump

1. WaterCare Systems are designed and intended to run continuously on a 24/7/365 basis. Do not stop-and-start pump repetitively as this can cause water hammer and result in damaged to system components. Please review the above information and the **Background, Operation & Use** presentation before installing or starting-up a WaterCare System.

2. Make sure all glued connections, especially on the pressure side of the loop, have had sufficient time to cure. Make sure all fittings are tight.

3. CLOSE the manual ball valve on the purge. **OPEN** the supply valve from the remote tower sump tank or the tower basin supply loop. Allow existing head pressure to flood the supply pipe work and pump. Open the **water-sampling valve** on the WaterCare System to allow air within the system to escape. Close the sampling valve when water comes out of the valve. Make sure the manual valve on the return pipe work, if installed, is **OPEN.**

4. Before turning ON the power to the controllers; **TURN ON** the pump to pressurize the system and check for leaks. Repair any leaks and/or tighten any fittings before proceeding.

5. WaterCare Systems are supplied with a 1,150 Joule surge suppression bar that supplies power to each of the controllers supplied with the system. Plug the lead from the surge bar into a 115V outlet. Locate the red ON/OFF switch on the surge bar and turn the power **ON**. Open both WaterCare System controllers and turn both ON. The power from the surge bar will automatically turn the timer or conductivity controller **ON.**

6. The CALCIUM CONTROLLER, which has a 2-conductor lead connected to the SmartFilter, requires no adjustments once it has been turned ON.

7. The BIOLOGICAL & CORROSION CONTROLLER regulates the amount of DC voltage that goes to the metal bars in the metals flowcell. It also automatically controls the timing and cycling from bar to bar (copper, silver, zinc) to control wear, boost silver production every 14 days (to inhibit resistance) and extend bar life.

The BIOLOGICAL & CORROSION CONTROLLER has a rotary dial with 10 stops that control the amount current being supplied to the metals bars. The DC current is used to generate the metal ions (ions are metal atoms minus electrons) and uses the conductivity of the water to carry the current from one bar towards the opposing bar. The flow passing between the bars carries the positively (+) charged metals ions off into the bulk water where the ions are attracted to a bacteria's negative (-) charge.

There are two lights on the controller. The **GREEN** light confirms the fan cooled controller has power. The YELLOW light comes on periodically to indicate a change in cycle from one copper bar to the next or, in shorter cycles, from one silver bar to the next.

If the conductivity of the bulk water is very low (i.e. start-up of freshly filled tower sump or chiller) it will not be able to carry a lot of current. The BIOLOGICAL & CORROSION CONTROLLER recognizes this and the **YELLOW** LED lights up as the rotary dial is turned clockwise from minimum (6 VDC) towards maximum (30 VDC).

The YELLOW light comes ON automatically when the controller, which automatically measures the conductivity of the bulk water between every cycle, recognizes the low conductivity and alerts the operator with the YELLOW light. This is the maximum output for the conductivity of the bulk water at that point in time. Turn the rotary dial down (counterclockwise) one click and the yellow light will go out.

As cooling tower water evaporates (see 8. CONDUCTIVITY) the minerals are left behind and increase in concentration. This increases the conductivity of the bulk water that increases the BIOLOGICAL & CORROSION CONTROLLER'S ability to produce more metal ions.

DO NOT run the BIOLOGICAL & CORROSION CONTROLLER with the **YELLOW** light turned **ON** continuously for any length of time. The extra current that cannot be carried by the conductivity of the bulk water will induce minerals in the bulk water to build up on the metals flowcell. At some point this build up could cover the entire surface of the bars and inhibit metal ion production. Turning up the rotary dial further simply speeds up this process. The result is that the metals flowcell would end up needing to be acid washed.

When a WaterCare System has been properly sized and selected for a specific application the metals flowcells should operate without building up a mineral coating on the surface of the metals bars.

Copper Test - Use the **copper drop test** kit supplied with the system to determine the copper level in the bulk water after 24-hours and daily thereafter to become familiar with the system and rotary dial adjustments. The **TARGET** copper level is 0.3 mg/L (PPM) and the silver level defaults to 0.005 mg/L (or 5 PPB) when the copper level is at 0.3 mg/L. See page 21 of the BACKGROUND, OPERATION & USE presentation for more information.

Rarely will a copper level of 0.5 mg/L be required except initially in cooling water system having high bacteria counts or biofilm that needs to be controlled (see BACTERIA TEST KITS below).

The copper test should be conducted and the results logged weekly.

8. CONDUCTIVITY

As water evaporates from a cooling tower the minerals in the water (dissolved solids - calcium, magnesium, iron, sodium, silica, etc.) are left behind and increase in concentration. As more and more water evaporates the mineral concentration (as measured by conductivity in most towers) increases.

Calcium carbonate is just one component of conductivity and, unlike salt or sugar, is very insoluble (about 7 mg/L). For this reason, it easily precipitates and causes many problems as it slowly grows the crystals we eventually see as mineral scale buildup. Magnesium, sodium and other minerals are very soluble and also contribute towards conductivity but can cycle-up 40 or 50-times their original concentration in the make-up water.

A natural by-product of the increasing mineral concentration in a cooling tower is an increase in alkalinity. Maintaining alkalinity of 400 to 600 mg/L will inhibit (arrest) corrosion. However, rarely will the alkalinity of a cooling tower's bulk water ever cycle up enough to hit the alkalinity level needed to inhibit corrosion.

To determine Cycles-of-Concentration simply divide the conductivity of the bleed set point by the conductivity of the make-up water (i.e. 1,200 µS / 300 µS = 4 cycles-of-concentration). Generally, all the other dissolved solids in the water contribute more to conductivity than calcium.

9. Conductivity Controller - WaterCare Systems are supplied with a TIMER to regulate the SmartFilter purge cycle as standard equipment. An optional conductivity controller can be supplied, if needed, in place of the timer for cooling tower applications. The conductivity controller OPEN the actuated ball valve to bleed water for conductivity control while also carrying suspended solids to a sanitary drain.

Conductivity Controller Calibration - A handheld conductivity meter is supplied with systems supplied with a conductivity controller to calibrate the sensor with the conductivity controller. First, before beginning, read the handheld meter's User Manual.

Calibration Test - Purge the system's water sampling valve of old water for several seconds then fill a clean cup with about 8 ounces of tower water. Remove the protective cap on the handheld meter and turn it ON. Allow handheld meter to go through its starting cycle until 0 µS is shown on the screen.

Place the handheld conductivity meter into the water sample. Mix the water with the handheld meter until the value on the screen stops changing (the handheld meter is temperature compensating so this can take a minute or two). The value on the screen will now be very close to the actual conductivity of the bulk water.

The handheld conductivity meter reads full values up to 1,900 µS. Any value at or above 2,000 µS will show on the handheld meter's screen as 2.0 µS or higher.

Calibration - Use the setscrew on left side of the conductivity controller to adjust (calibrate) the sensor readout on conductivity controller's screen with the value on the handheld meter.

Sensor Cleaning - Remove and clean sensor every three months with CLR.

Test Frequency - Conductivity sensor calibration should be checked weekly.

Bleed-Set-Point - The bleed set point needs the tower will run and needs to be set. The set-point OPENS and CLOSES the actuated ball valve so filter purge is used to regulate tower conductivity.

PUSH and HOLD the **READ** button and use the set-screw on far right to adjust the readout on the conductivity controllers screen to the desired bleed set-point. **RELEASE** the READ button. The conductivity controller will now automatically OPEN and CLOSE the filter purge actuated ball valve as the conductivity of the bulk water approaches the bleed-set-point.

ALARM LIGHT - The conductivity controller supplied with the system works on about a 100 µS ***DIFFERENTIAL***. If the bleed-set-point is set to 1,500 µS then the ALARM LIGHT will come on whenever the actual conductivity of the bulk water is above or below the 100 mS differential.

This light will turn ON and OFF routinely as the conductivity of the bulk water passes through both differential limits as water continues to evaporate before make-up water is added to the system and afterwards as make-up water dilutes the bulk water. This ALARM light serves no other function or purpose other than to alert an operator that the actual conductivity of the bulk water is either above or below the bleed setpoint differential.

WARNING: Adjust the manual ball valve ahead of the actuated ball valve to regulate the ***purge flow rate*** so that it **does not exceed** the rate at which make-up water is supplied to the tower. Not following this direction could cause a conductivity control bleed cycle to empty the tower basin or sump tank and potentially result in damage to pumps, seals and cooling water dependent equipment.

Installing a short length of clear PVC pipe in-line in the filter purge pipe work makes "seeing" the flow rate to the drain making adjustments to the purge flow rate much easier.

PUSH and **HOLD** the TEST button to run a test of the actuated ball valve. **RELEASE** the button to close the valve. This TEST should be conducted daily on cooling tower systems for the first two weeks of operation to insure the purge pipe work does not become plugged with fine debris that was not being removed previously.

10. BACTERIAL TEST KIT - Nexteq suggests every customer follow the water sampling method below to determine the bacteria counts of the existing bulk water on start-up and thereafter for 3 or 4 days until the operator or operators become familiar with the test and how to read it.

Most of the pathogens of concern in process cooling water are bacteria (i.e. Legionella). For this reason each WaterCare System is supplied with one box of Biosan SaniCheck bacteria tests with **10 sterile sample bottles** and a bacteria count comparison chart. Follow the manufacturer s sampling and comparison instructions supplied with the bacteria test kits. THIS IS A 24-HOUR TO 36-HOUR TEST.

Sampling Method - WaterCare Systems are supplied with a water-sampling valve. It is important to always purge old water that may have been sitting in the sampling valve before taking any water samples for any of the tests (copper, conductivity, bacteria and alkalinity for chilled water systems). This is especially true for the bacteria test.

- Always conduct the bacteria test at a time when it can be looked at 24 to 36-hours later.
- Write time and date on the sample label or write this info on the sample bottle with a Sharpie pen.
- Purge the sampling valve and put 8 ounces or more in a clean cup or container.
- Remove the cap and media paddle being careful not to touch the growth media on the paddle.
- Place the media paddle into the water sample for 2 to 3 seconds.
- Allow excess water to drop off paddle and place the paddle back in to its container.
- Compare the growth spots on the media paddle at 24-hours (START - minimum growth period)
- Compare the growth spots on the media paddle at 36-hours (END - maximum growth period)
- Record results on supplied test log.
- Repeat tests as needed.
- Repeat bacteria test following your company or your organization’s mandates.

The media paddle attached to the lid of the sample bottle should be compared with the Reference Chart supplied in the box no sooner than 24-hours after inoculating the media and no longer than 36-hours after inoculation. Bacteria spots will continue to grow on the media long after this period of time. Any reading before 24-hours and after 36-hours is not valid. The sample bottle should be disposed of and repeat the test if there is any question about any test results. The 30-hour point will provide best average results.

Nexteq suggests the bacteria test be conducted daily for the first three days to become familiar with the bacteria and the other tests. Then move to weekly for the next three weeks and monthly thereafter. Compare the bacteria test with the copper test to see how one test relates to the other test.

CHILLED or CLOSED-LOOP SYSTEMS - 500 to 7,500 Gallon Systems

START-UP STEPS - WaterCare Systems with Integral Recirculation Pump

11. CHILLER or CLOSED-LOOP WATER SYSTEMS - Typically, chilled water systems or closed loops have the same needs as cooling towers. Most have very little if any evaporative loss and lose water from leaks or when production equipment is changed out.

Filtration - Filtration factors in less with closed or chilled water loops than towers because debris isn't constantly being sucked into the cooling water as it passes through a cooling tower.

That isn't to say closed or chilled water loops don't have their challenges. Often biological control is overlooked purely because it is a closed loop.

Biological Control - Most folks are surprised to learn people can be exposed to pathogens and become very sick from inhaling droplets of water that can spray into the air when a cooling hose under pressure is disconnected. Like a cooling tower, pathogens enter the cooling system in the city make-up water then multiply within the systems.

Surprisingly, almost 25,000 people are exposed to Legionella every year and, of these, almost 4,000 die annually (source: US CDC/EPA; http://www.enviroanalysis.com/legionellae.htm).

Note: Follow the instructions given in **START-UP & OPERATION** above. Also see **Alkalinity** below.

Calcium Control - Calcium control can be less of an issue but can present problems with a number of production processes. Calcium control is an integral feature of the 2-in-1 SmartFilter.

Alkalinity - They key to controlling corrosion in a process cooling water or chilled water system is alkalinity. Maintaining alkalinity of between 500 and 600 mg/L will virtually arrest corrosion in a process cooling water system.

WaterCare Systems that will be used for closed chilled water systems or heat exchanger based temperature-controlled water loops are supplied with an ALKALINITY test kit.

Simply follow the alkalinity test kit instructions to determine how much alkalinity is in the system. Then add **BAKING SODA**, several pounds at a time, until the alkalinity reaches 600 to 800 mg/L. Allow the cooling water to mix thoroughly for several minutes to insure correct test results.

The 600 to 800 mg/L alkalinity goal level is higher to provide the cooling loop with a little residual buffering to carry it through between weekly tests. Every system is different so that while alkalinity would be tested weekly adding baking soda may only be needed monthly.

Adding baking soda also increases the conductivity of the bulk water making it easier for the metals flowcell to generate copper & silver ions.

Once bacteria levels achieve desired levels the copper output can be reduced so that excess copper (more than what can be consumed with bacteria production) is not produced.

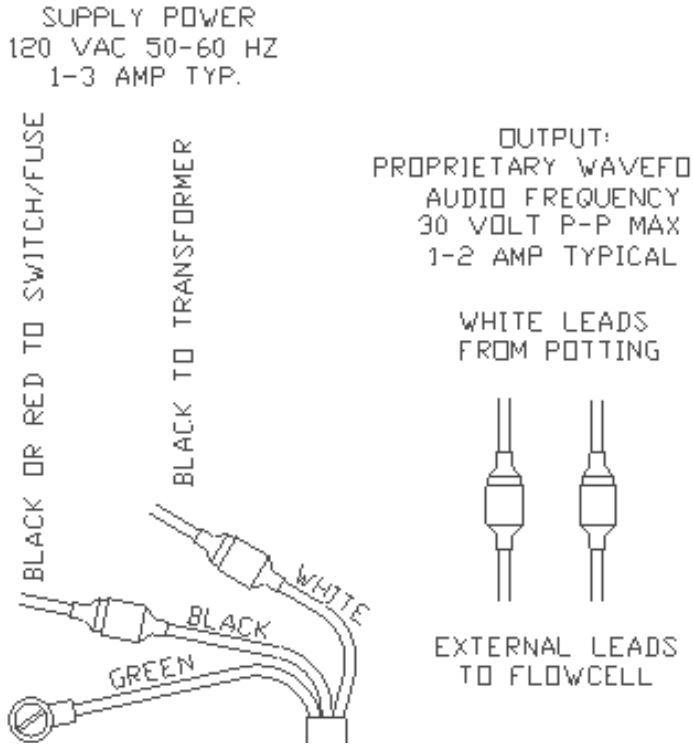
In closed cooling loops most customers find 0.2 mg/L or less is all that is required to maintain bacteria levels of 10^2 or less. In some cases, customers have put their metals controller on a timer so it runs for fewer hours per day.

QUESTIONS? Please call: 440-725-5057

NON-CHEMICAL

NEXTEQ WaterCare™ Systems

WIRING DIAGRAMS

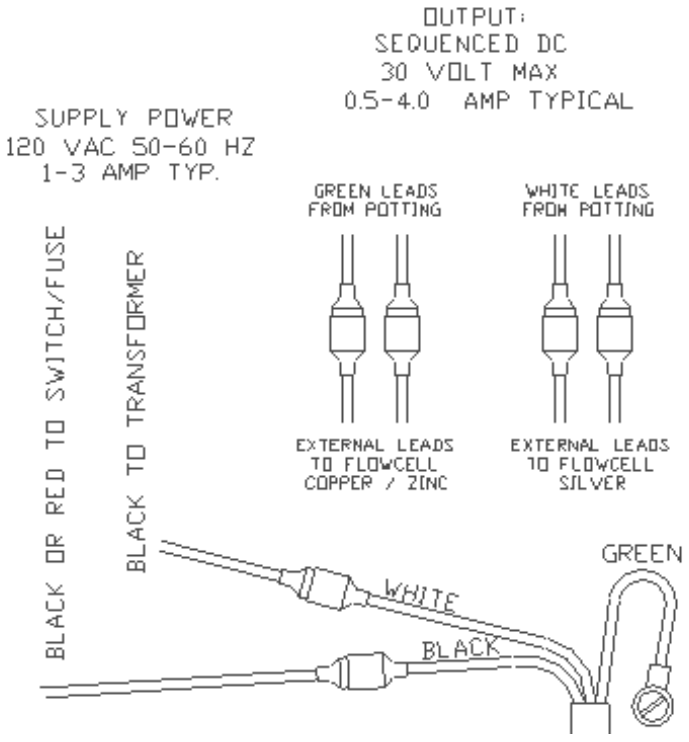


CALCIUM CONTROLLER

Models: SF-500 through SF-5000

BIOLOGICAL & CORROSION CONTROLLER

Models: SF-500 through SF-5000



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